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# Fusion of Palm Print and Iris for Multimodal Biometric Recognition

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***Abstract-*** Now a day the security is very important in our daily life. The pattern of the human body is well suited to be applied to access control and provides security in biometric person identification technique. For following two basic purposes security system is used: to verify or identify users. In this paper focus on a powerful methodology for Capturing, matching and verifying for human recognition with feature extraction from iris and palm print of single person. These features of an input image are compared with those of a database image to obtain matching scores. Based on the accuracy during matching process the result is given as the person is authorized or not.It is desirable to develop a feature analysis method which is ideally both discriminating and robust for iris and palm print biometrics.

***Index Terms-*** feature extraction, matching scores, discriminating and robust.

## I. INTRODUCTION

Biometrics is the science and technology of measuring and analyzing biological data of human body, extracting a feature set from the acquired data, and comparing this set against to the template set in the database [1]. Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years. Basically we identify the people using passwords, PINs, smart cards, tokens, keys etc. but these are sometimes misplaced, forgotten, purloined or duplicate and hard to remember. However an individual's biological traits cannot be misplaced, forgotten, stolen or forged. Biometric-based technologies include identification based on physiological characteristics (such as face, fingerprints, finger geometry, hand geometry, hand veins, palm, iris, retina, ear and voice) and behavioral traits (such as gait, signature and keystroke dynamics) [2].Human physiological and/or behavioral characteristic can be used as a biometric trait when it satisfies the requirements like ubiquity, peculiarity, stability and collectability. In practice, no single biometric can satisfy all the desirable characteristics mentioned above for it to be used for person authentication. This is due to the problems associated with noisy data, intra-class variation, non-universality, spoof attacks and high error rates [4]. To overcome this limitation, multiple biometric features can be used for person authentication. This resulted in the development of multimodal biometric person authentication system [4]. Thus biometric system can be classified as uni-modal system and multimodal system based on whether single or multiple biometric features are used for person authentication.

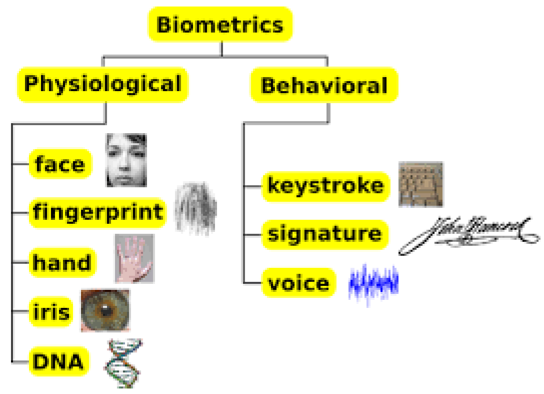



**Fig 1: Types of Biometrics**

## II. BIOMETRIC SECURITY SYSTEM

Biometric security system becomes a efficient tool compared to electronics based security systems [3]. Multimodal biometric authentication techniques attract much attention of many researches recently as the fusion between many different modalities can increase the recognition rate. The fusion can be achieved in different levels such as sensor, feature, or classification level. The literature reported that the multimodal biometric methods achieve better recognition rates than uni-modal biometric methods. From the uni-modal biometrics data, two traits of iris [5] and palm print [6] are recently best authentication biometrics. Biometrics authentication is known as realistic authentication is used in computer science for identification and access control. It is also used to identify individuals in groups that are under supervision.

## III. MULTIMODAL

The multimodal-based authentication can help the system to increase the security and efficiency in contrast to uni-modal biometric authentication, and it would be very difficult for a rival to spoof the system because of two distinct biometrics features. Multimodal biometrics fusion techniques have attracted much attention as the supplementary information between different modalities could improve the recognition performance. Information from different biometrics traits can be integrated at the feature level (integrating the features of different biometrics), score level (combining the genuine and imposter scores), or decision level (combining the decisions). Although feature sets are the rich source of information, features from these modalities may not be compatible. Moreover large dimensionality of a feature space may lead to irrelevant and the redundant information [15].

**Fig 2: Examples of Multimodal**

***Face Recognition***: Face recognition has records of different features of the face in spatial geometry form. Many kind of methods for face recognition using in different field. But, all are having objective of features measure from the face as a key factor. Face recognition has been used in projects to identify undesirables in criminals and terrorists in urban areas shoplifters in stores, casinos. This kind of biometric system can easily spoof by malicious intruders and the criminals to cheat a recognition system. But, Iris cannot be spoofed easily.

***Palm Print*****:** Palm print scanning uses is very similar to fingerprint scanning; it size is much big, but limited factor only use in recognition system.

***Signature Verification***: It is an automated method of testing an individual's signature. This is dynamic such as direction and pressure of writing, speed and the style. Signature verification has template from 50 to 300 bytes. Disadvantages of signature verification are long-term reliability, lack of accuracy and cost.

***Fingerprint:*** A fingerprint attains device, minutia extractor and minutia matcher. Commonly, this biometric recognition used in banking, military etc., but it can be spoofed easily and difficult to scan due to the causes of wearing gloves, using cleaning fluids, etc..,

## IV. 4. IRIS DETECTION

**Iris Scan***:* Iris gives reliable and accuracy for authentication process than other biometric feature. Iris has different patterns in the left and right eye. So, scanning has to be done quickly for both identification and verification applications because of its large number of degrees of freedom. The amount of light entering through the pupil is controlled by diaphragm between the pupil and the sclera. Iris is composed of elastic connective tissue such as trabecular meshwork. Suitability of this as an exceptionally accurate biometric derives from:

i. The difficulty of using as an imposter person and forging;
ii. It is protection and intrinsic isolation from the external Environment;
iii. Its data-rich physical structure.

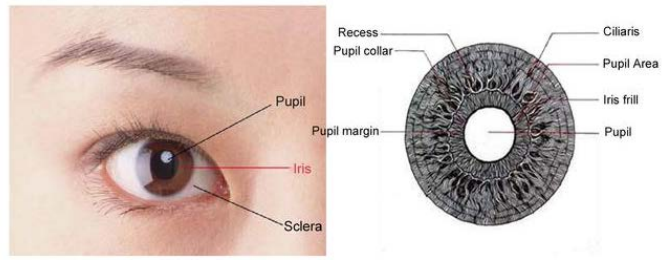



**Fig 3: Structure of Iris**

iv. Its genetic properties: no two eyes are the same. The Characteristic that is dependent on genetics is the pigmentation of the iris, which determines the gross anatomy and its color that are unique to each case.

v. Its stability over time; there is no possibility of surgically modification of risk to vision and its physiological response to light, which provides a natural test against artifice. An image-processing algorithm that can encode the iris pattern into 256 bytes based on the Gabor transform.

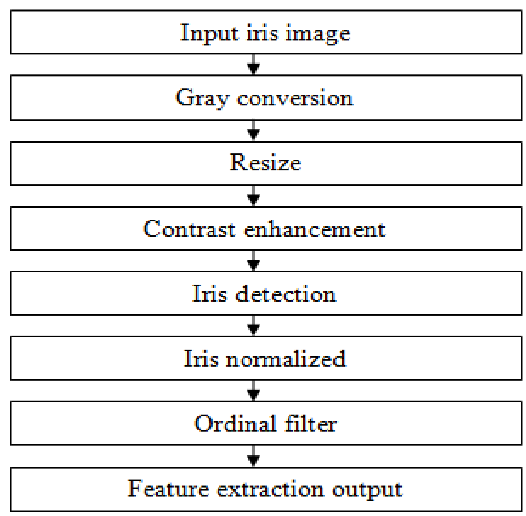



**Fig 4: Steps of the Iris Recognition**

**Gray code:** widely, Gray codes are used to facilitate error correction in digital communications such as digital terrestrial television.

**Contrast Enhancement Techniques:**

1) Load Images
2) Resize Images
3) Enhance Grayscale Images
4) Enhance Color Images

*Load Images:* Read images

*Resize Images:* Resize the images and make the image comparison easier for same width. Preserve their aspect ratios by scaling their heights.

*Enhance Grayscale Image:* There are three functions are suitable for contrast enhancement:

***a) imadjust,***
***b) histeq and***
c) ***adapthisteq***.

**Imadjust**: It is increases the contrast of the image by mapping the values of the input intensity image to new values such that, default value 1% of the data is saturated at low and high intensity of the input data.

**Histeq**: Operation of histogram equalization is enhances the contrast of images by transforming the values in an intensity image for the approximate histogram matches of output image to a specified histogram.

**Adapthisteq**: Operation of adaptive histogram equalization is contrast-limit. It operates on small data regions rather than the entire image, unlike histeq. The contrast enhancement can be limited in order to avoid enlarge the noise which might be present in the image.

| Method | Coded Pattern | Mis-identific | Security | Application |
|---|---|---|---|---|
| Iris Recognition | Iris pattern | 1/1200000 | High | High security facilities |
| Finger printing | Fingerprints | 1/1,000 | Medium | Universal |
| Hand Shape Size, | Length and thickness | 1/700 | Low | Low-security facilities |
| Facial Recognition | Outline, shape and distribution of | 1/100 | Low | Low-security facilities |
| Signature | Shape of letters | 1/100 | Low | Low-security facilities |
| Voice printing | Voice characteristic | 1/30 | Low | Telephone service |

**Table1 (a): Biometric comparison List**

| Biometrics | Crossover Accuracy |
|---|---|
| Retinal Scan | 1:10,000,000+ |
| Iris Scan | 1:131,000 |
| Fingerprints | 1:500 |
| Hand Geometry | 1:500 |
| Signature Dynamics | 1:50 |
| Voice Dynamics | 1:50 |

**Table1 (b): Biometric comparison List**

## V. IRIS DETECTION AND SEGMENTATION

**Iris Detection**

Irises are detected even the situation of obstructions, visual noise and different levels of illumination. Eyelids and eyelashes obstructions are eliminated and Lighting reflected. Images with narrowed eyelids or eyes that are gazing away are accepted using wavelet algorithm.

*Automatic interlacing detection and correction*: The result of correction in maximum quality of iris features templates from moving iris images.

*Gazing-away eyes***:** A gazing-away iris image is correctly detected, segmented and transformed when we directly looking into the camera.

**Iris Segmentation**:

It can achieved by following conditions:

*Perfect circles fail: It* uses VeriEye active shape models that much precisely model the contours of the eye, as perfect circles do not model iris boundaries.

*The centers of the iris inner and outer boundaries are different:* The iris boundary of inner and its center are marked in red; The iris boundary of outer and its center are marked in green.

**Locating Iris**

1) To locating the inner and outer boundaries of the iris
2) To normalize iris and
3) To enhance the original image

$$\max(r, x0, y0) = \left\{ \frac{\partial}{\partial r} \int_0^{2\pi} I(r * \cos\theta + x0, r * \sin\theta + y0) \right\}$$

**…(1)**

Where,
(x0, y0) denotes the potential center of the searched circular boundary, and r its radius.

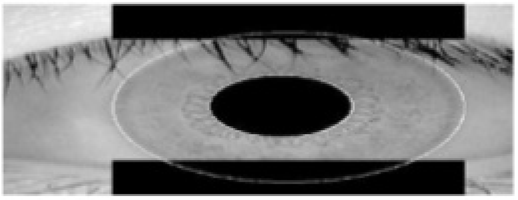


**Fig 5: Segmented iris**

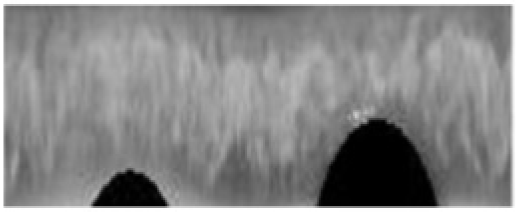


**Fig 6: Normalized iris**

## VI. PALMPRINT

A CCD-based scanner used to capture images in high resolution and aligns palms accurately because of its pegs for guiding the placement of hand. Digital scanners are requires large time for scanning because of its low quality. This is reason for digital scanners cannot be used in real time applications.

**Fig 7: CCD Based Scanner**

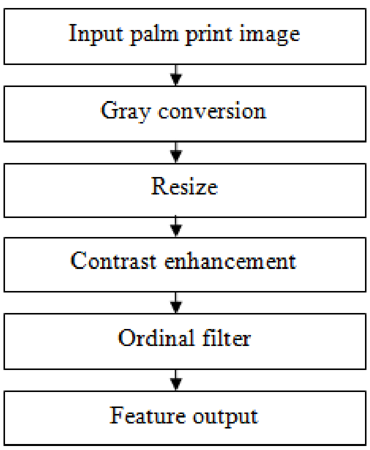



**Fig 8: Steps of the palmprint Recognition System**

**Preprocessing**

Preprocessing is used to correct distortions, align different palmprints, and to crop the region of interest for feature extraction. Preprocessing commonly focuses on five steps

1. Binarizing the palm images
2. Boundary tracking
3. Identification of key points
4. Establishing a coordination system and
5. Extracting the central part. The third step can be well equipped by two approaches: *tangen*t based and *finger* based. The tangent based approach is preferred. This approach considers the edges of the two finger holes on the binary image to be traced. The common tangent of the two finger holes is considered to be the axis. The key points for the coordination system are calculated as the midpoint of the two tangent points.

The palmprint recognition system includes preprocessing followed by ROI extraction. After ROI extraction, features are extracted using the feature extraction algorithms.

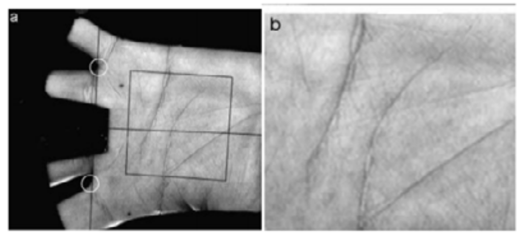


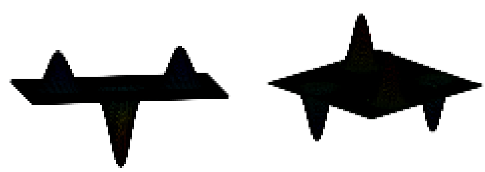

**Fig 9: (a) key points and coordinate system (b)ROI extraction**

**ROI extraction:** It considers middle area of palm image for segmentation after the preprocessing. For feature extraction different algorithms are segment as circular, half elliptical or square regions. The square region is widely used. The cropped image is then passed through an ordinal filter, which blurs the image. In this blurred image, the minor lines smothered. In feature extraction the major lines are affected, but they are distinct.

**Ordinal Filters**

The ordinal features are extracted by passing the input images through the ordinal filters. For the registration experiments all the operations are performed in three dimensions. We just show concepts in 2D cases for better illustration. Easily, it can be extended to 3D. Comparison of neighboring regions Gabor filter is a well known differential filter. It has disadvantages of the span of the Gabor filter is limited by the size of its sub-fields, therefore it is difficult to capture useful information from small regions across large distances.

With multiple lobes the ordinal filter can extended more complex microstructures than the dipole filter. Also, using different shapes of individual lobe, the ordinal filter can be planned to extract different specified micro-structures from the images.



(a) (b)

**Fig 10:(a)A 3$^{rd}$ Order Ordinal Filter Applied (b)A 4$^{th}$ Order Ordinal Filter Applied**

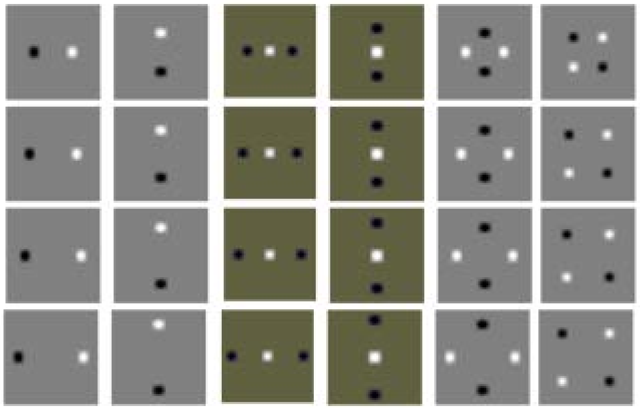


**Fig 11: Sample of ordinal filter used**

**Fusion:**

Fusion of multiple features of an individual can improve the matching accuracy of a biometric recognition system. a system that consolidates multiple sources of biometric information that avoid noisy data, intra-class variations, spoof attacks and unacceptable error rates of a unibiometric recognition system. Multimodal biometric systems are capability of utilizing, more than one physiological or behavioral characteristic for enrollment, verification, or identification. The multimodal biometric is very promising applications and theoretical challenges in recent years.

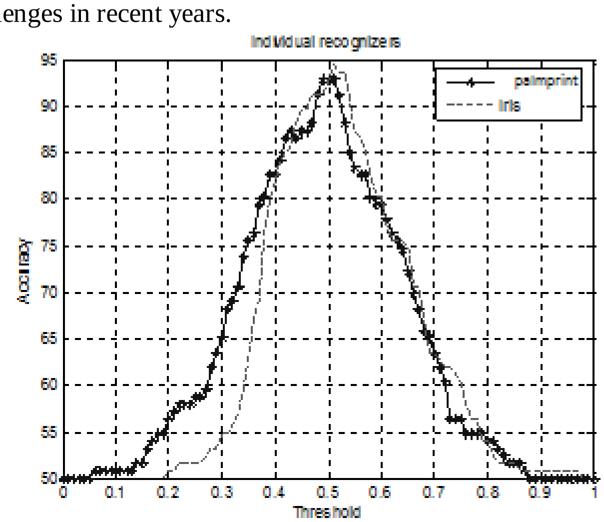



**Fig 12: Accuracy plots of individual recognizers**

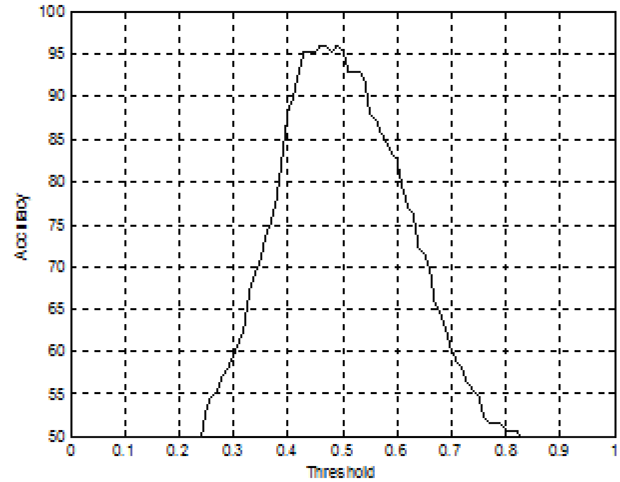



**Fig 13: Accuracy graph for combined classifier**

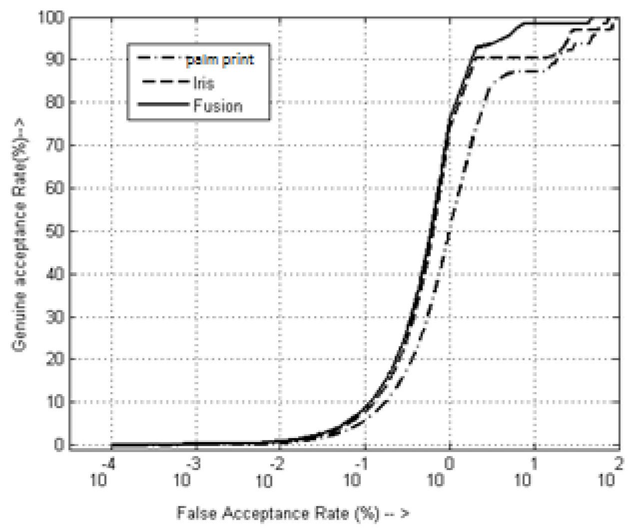



**Fig 14: curve for palmpint, iris and fusion**

## VII. PATTERN MATCHING

To obtained vector in a binary pattern matching is very important to represent code. It is easier to find the difference between two binary code-words than between two number vectors. If the feature vector has to code first observed some of its characteristics from it. Now found that all the vectors that we obtained have a maximum value that is >0 and a minimum value that is < 0. If "Coef" is the feature vector of an image than the following measuring scheme converts it to its Equivalent code word

- ★ if Coef(i) >=0 then Coef(i)=1
- ★ if Coef(i) < 0 then Coef(i)=0

## VIII. IDENTIFICATION AND VERIFICATION

Every security system has goals of two: *Identification* and *verification* it based on the needs of the environment. In the *verification*: In this the system checks if the user data that was entered is correct or not (e.g., username and password). It is a one-to-one search.

*Identification*: In this the system tries to discover who the subject is without any input information. It is a one-to-many comparison.

## IX. RELATED WORK

### A. Existing system

A multimodal biometric system that alleviates the limitations of the uni-modal biometric systems by fusing the information from the respective biometric sources was developed. A general approach was explained for the fusion at score level by combining the scores from multiple biometrics using triangular norms (t-norms) due to Hamacher, Yager, Frank, Schweizer and Sklar, and Einstein product. This study aims at tapping the potential of t-norms for multimodal biometrics. The approach renders very good performance as it was quite computationally fast and outperforms the score level fusion using the combination approach (min, mean, and sum) and classification approaches like SVM, logistic linear regression, MLP, etc. The experimental evaluation on three databases confirms the effectiveness of score level fusion using t-norms.

In this phase, the two set features will be extracted from iris and palm images. At first, the palm image will be preprocessed to get the palm ROI (Region of interest), and palm print features of wrinkles, ridges and principal lines will be extracted from the palm ROI. On other hand, localization process will be applied on the iris images; some useful features will be extracted. Subsequently, the extracted features will be fused together at the feature level to construct the multi-biometric template.

### B. Proposed System

In this phase, some additional features will be selected based on iris and knuckle print of image presented in the database. The additional features provided based on iris and knuckle print image will provide the significant improvement as compared with existing algorithm. The implementation will be done in MATLAB and the performance of the algorithms will be analyzed using false alarm rate (FAR), False rejection rate (FRR) and accuracy. This result will be send to mobile through message.

## X. MODULE DESCRIPTION

The following three modules are in this project.

### a. Iris detection:

In eye information is carrying by iris part only. It lies between the sclera and the pupil. The next step is segmenting the iris part from the eye image. Using the eigen values inner and outer boundaries of iris are located by finding the edge image. This mathematical pattern-recognition techniques is used in irises of an individual's eyes, whose complex random patterns are stable, unique and can be seen from some distance.

### b. Palm Pre-Processing:

To understand palmprint recognition concept, one must first understand the valleys of a palm and physiology of the ridges. When recorded, a palm print appears as a series of dark lines and represents the high, peaking portion of the friction ridged skin while the valley between these ridges appears as a white space and shallow portion of the friction ridged skin. palm features exploits by Palm recognition technology. A palm recognition system is planned to interpret the flow of the overall ridges to assign a classification and then after extract the minutiae detail a subset of the total amount of information available, desire information to effectively search a large treasury of palm prints. Minutiae are limited based on location, direction, and orientation of the ridge endings along a ridge path.

### C.

### D. PCA Fusion & Recognition

Principal Component Analysis algorithm builds a fused feature of input palm prints and Iris as a weighted of all features. The classifier based on the Euclidean distance has been used which is obtained by calculating the distance between the image which are to be tested and the already available images used as the training images. Then the minimum distance is observed from the set of values.

## XI. CONCLUSION

A proposed work is to enlarge the algorithm for Powerful recognition with human iris and palmprint pattern identification. It done by increasing FRR more than 0.33% as the VeriEye algorithm results with FRR 0.32% and FAR 0.001% for other applications. Ordinal feature extraction for robust and fast matching use in healthcare application, suitable for reliable, fast and secure person identification. Proposed algorithm focus on the accurate of iris and palmprint identification even if the images are occlude and it will also focus on robust iris and palmprint recognition with narrowed eye which solves all the security related problems in system.

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